



## Comparing the Functionality of Available Recirculating Lab Faucets

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## Background

- ❖ There are a variety of purified water or de-ionized water laboratory faucets for lab use available in today's market
- ❖ Cleanest water from a standpoint of microbial growth are those of a recirculating design.
- ❖ The authors wish to
  - Demonstrate that installation can nullify the advantages of recirculation
  - Show the capabilities of the most popular recirculating lab faucets (RLF) available
  - Introduce a revolutionary concept for a new RLF and a novel use of an inline flow diverter (IFD) in the main conduit to create a pressure differential across the RLF



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In this example the water isn't going anywhere

## Off a Serpentine Loop System:

- Unrestricted flow needed
- Pressure differential provided by a restrictor of some type is mandatory



Pressure drop needed here

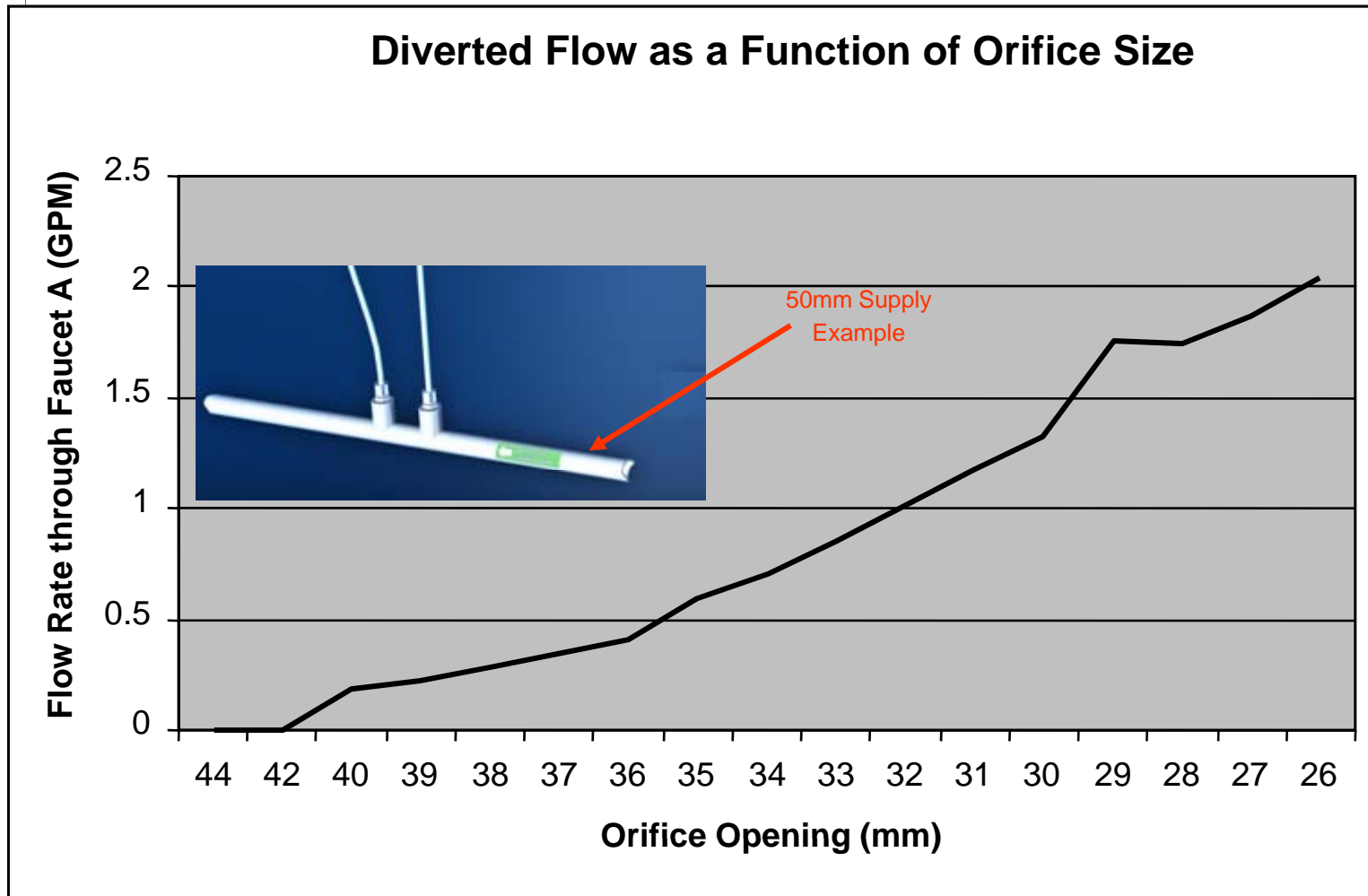
## Off a Supply/Return Loop System:

- Pressure delta of 15 to 30 psi on Supply/Return needed
- If this is not achievable then a restrictor of some type should be added





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## Evaluation of Restrictors (Inline Flow Diverter)

- Two different approaches to remedy the flow challenges where insufficient differential pressure was present were investigated.

The first approach used a modified 50mm Georg Fischer Type 315 Progef Plus® membrane valve with a 1/2" In/Out on each side of the weir.



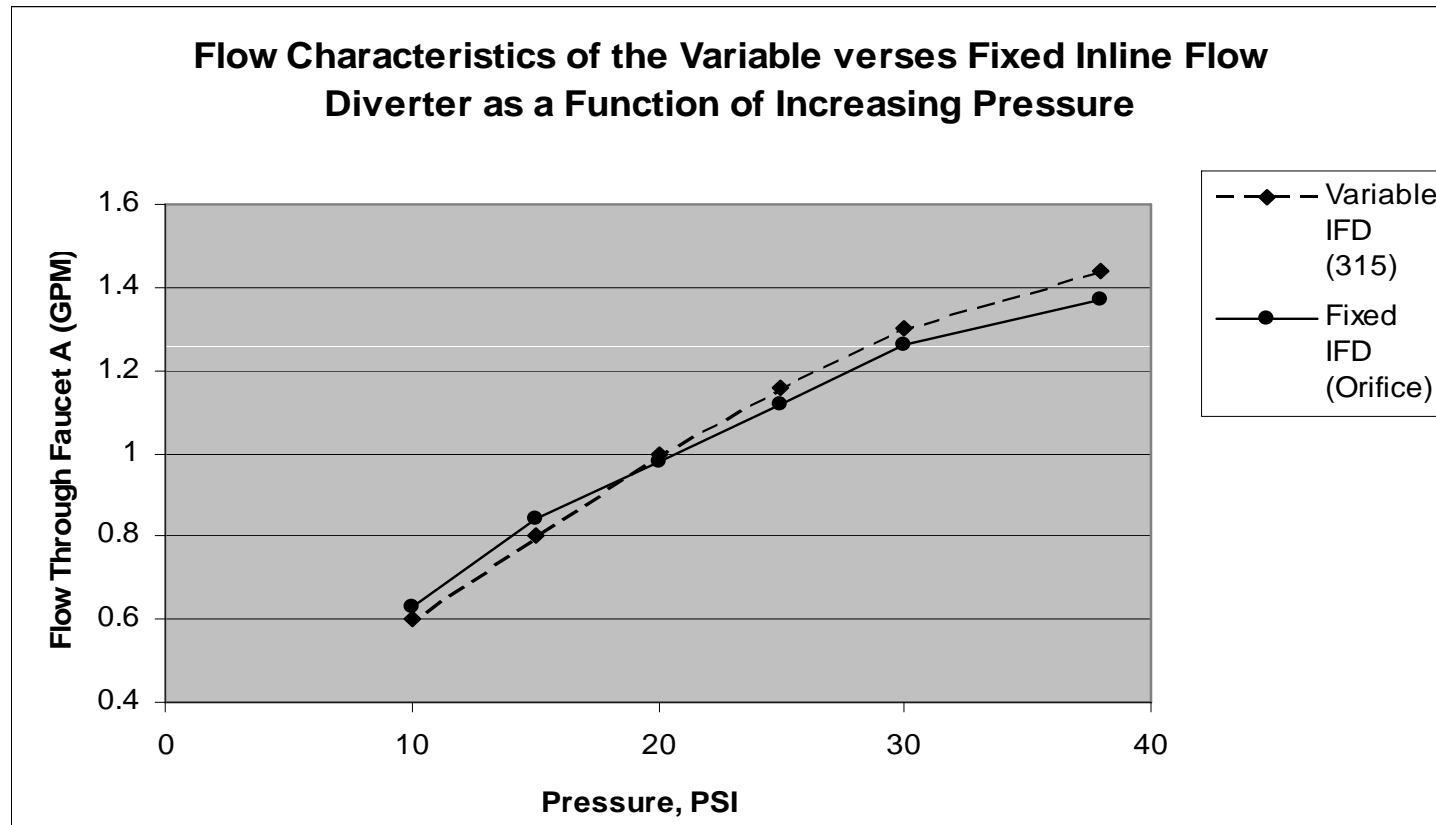
The second approach used a fixed diameter orifice plate to create the pressure differential.



Note: The Inline Flow Diverter shown here is Patent Pending



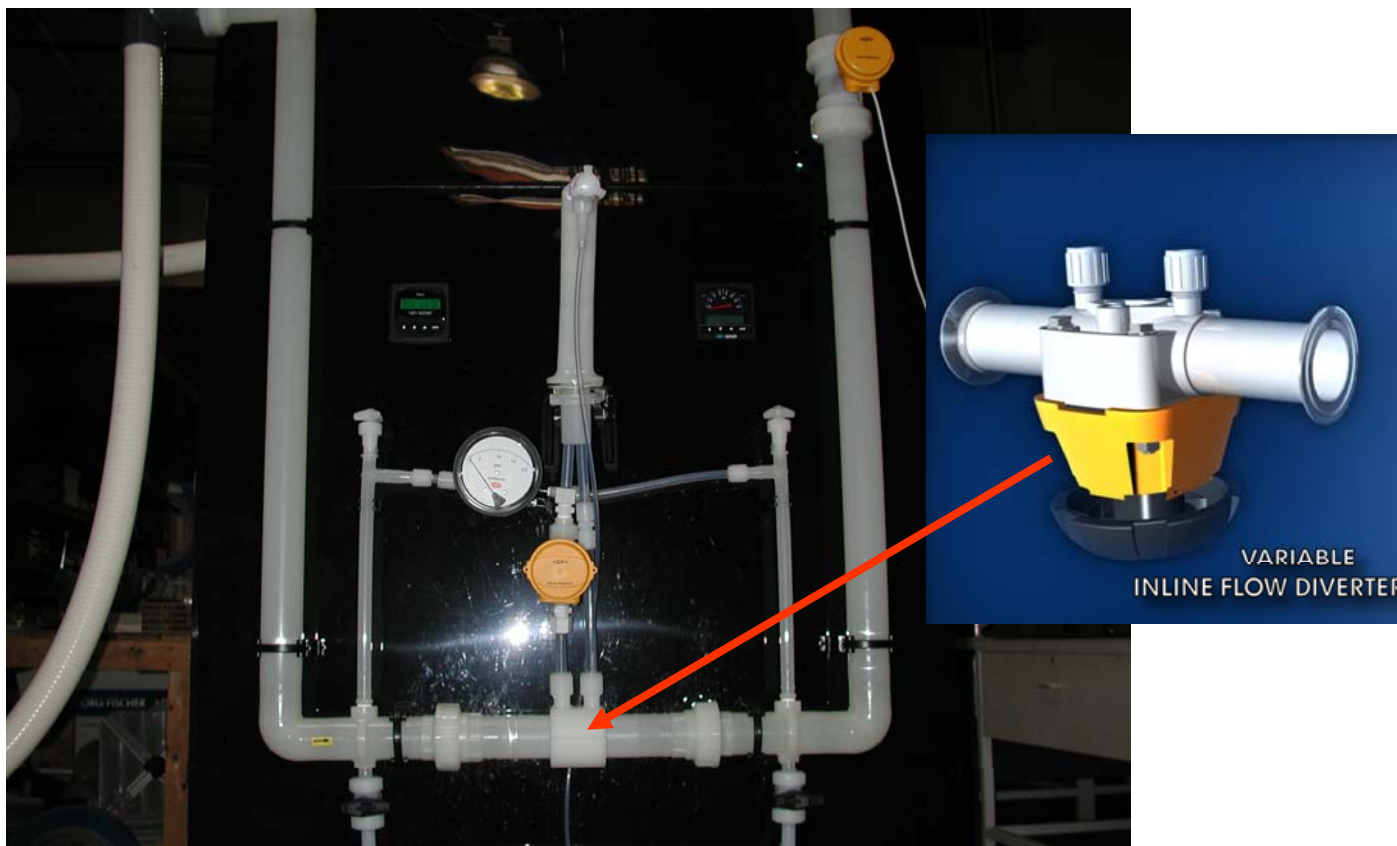
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Various sized plate diameter orifices were tested to correlate the orifice opening with the fully open variable IFD and obtain similar pressure drop and flow characteristics. Once established, all subsequent testing used the 315 IFD only.



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Using an ultrapure water loop constructed of Sygef® Plus PVDF pipe, all RLFs were connected one at a time for testing. The amount of flow was determined by use of a George Fischer Signet type 2550 Mag Meter.



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## Experimental

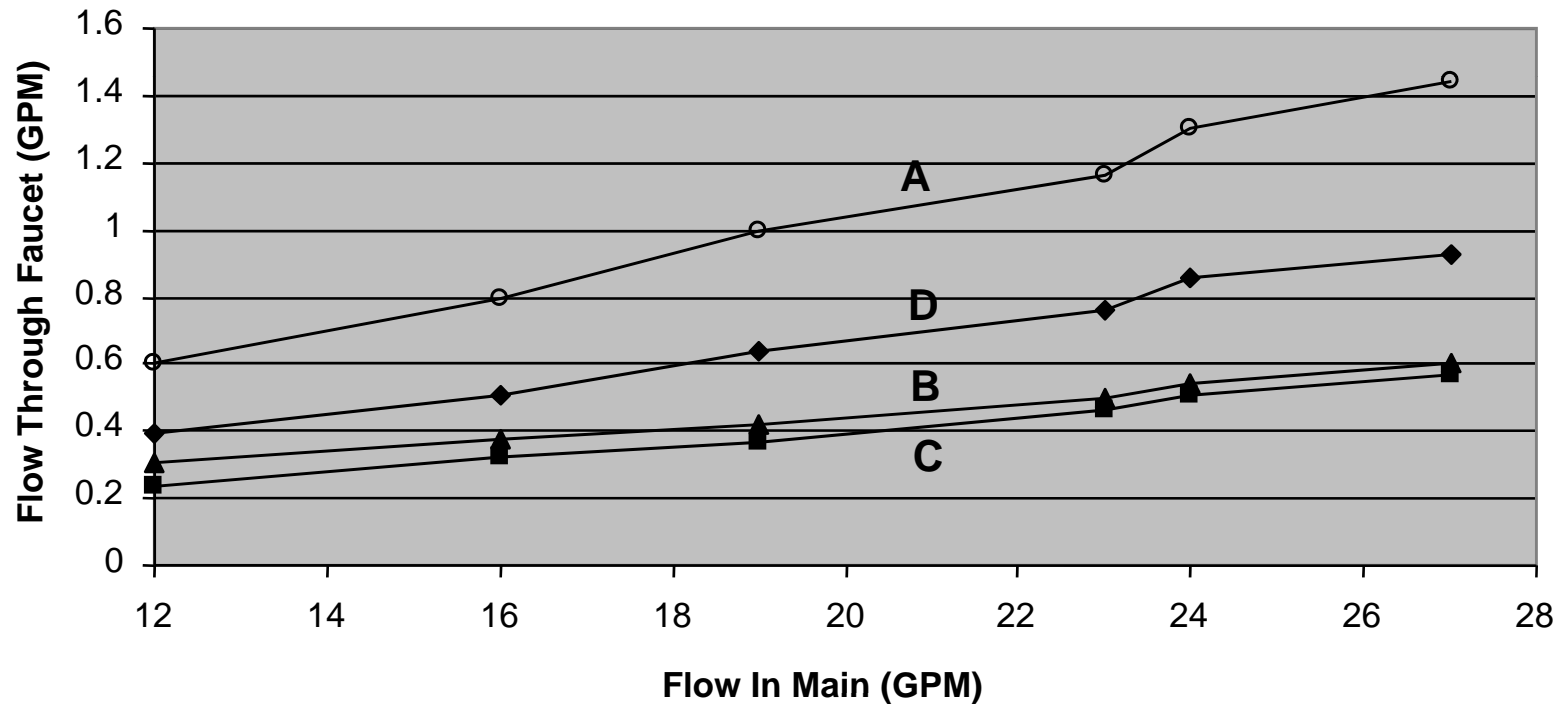
- RLFs from four different suppliers labeled Faucet A through D were tested under various flow conditions.

Faucet	Design	Features/Characteristics/Typical Application
A	Dual unobstructed PFA tubes within a robust molded housing	Standard 2" deck or wall mounting base. Two unobstructed 1/2" ID PFA tubes within the housing for supply/return to the needle valve outlet
B	Pipe within a pipe terminating with a needle valve at the faucet outlet	Compact design (hence small pipe diameters), threaded under sink connection for water lines, fits standard 2" deck opening found in most laboratories
C	Block base design	Non standard connector ports for the in/out lines Water only circulates at the base, leaving the faucet gooseneck line stagnant
D	Pipe within a pipe terminating with a needle valve at the faucet outlet	Larger diameter pipes and overall larger size when compared to B



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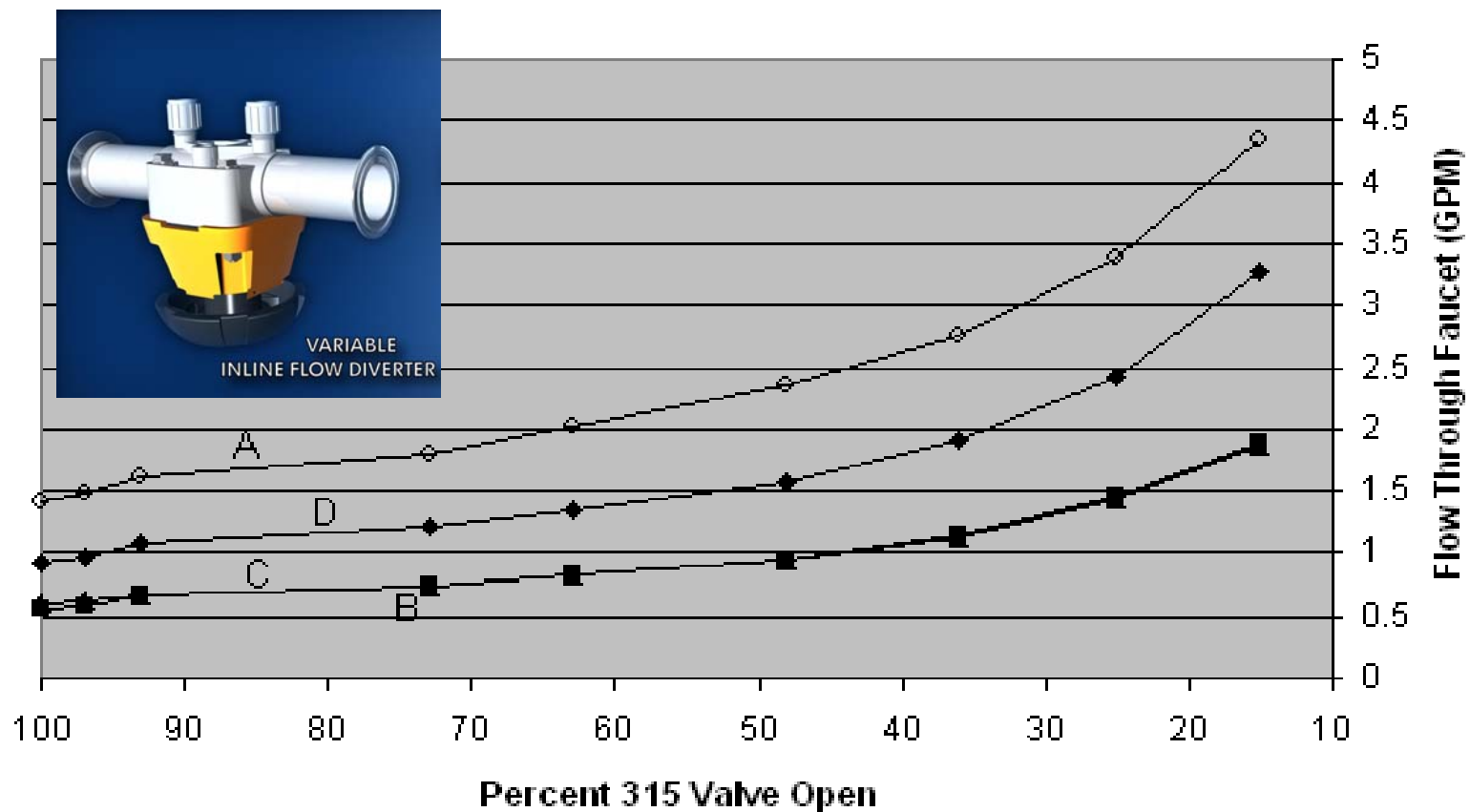
Increasing Flow in the Main Results in Increasing Flow through the Faucet





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## Percent IFD (315) Open verses Flow Through the Faucet





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## Summary and Conclusions:

- 1) Recirculating Lab Faucets (RLF) vary greatly in their design and functionality.
- 2) Design characteristics and installation can have a profound effect on the performance of a RLF. Just like any other zero static valves, they can either prevent or promote the occurrence of stagnation as shown elsewhere in the literature
- 3) A differential pressure across the supply and return avoids times of stagnation and possible microbial growth within the RLF itself.
- 4) When possible, a RLF should only be connected to a supply line and separate return line with a pressure delta of fifteen to thirty psi.





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### Summary and Conclusions (continued):

- 5) If a separate return line is not available a pressure differential device, such as an inline flow diverter (IFD), is absolutely necessary for any RLF to operate efficiently.
- 6) In cases where there is only minimal pressure differential those RLFs with unrestricted flow perform better. For example, the Aqua Tap™ (RLF - Faucet A) performed remarkably better than the other three RLFs tested, regardless of flow conditions. However, in our testing an IFD was needed to achieve any circulation in all RLF's tested including the Aqua Tap™.
- 7) We found that main line pressure is irrelevant (as it relates to the flow delivered through the faucets).



Note: The Inline Flow Diverter shown here is Patent Pending